BNL-81757-2008-AB

A SYNERGY OF MICROWAVE CLOUD TOMOGRAPHY AND SCANNING RADAR: MOVING TOWARD A 3D VIEW OF CLOUDS

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For presentation at the
American Geophysical Union Fall Meeting
San Francisco, CA
December 15-17, 2008

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ABSTRACT

Clouds are a central focus of the DOE Atmospheric Radiation Measurement (ARM) and many other programs. A 3D view of clouds would allow not only a better understanding/treatment of cloud processes, but also an opportunity to test cloud-resolving models more realistically, something that is not possible with the existing mode of "soda-straw" observations. This work first centers on combining two complementary techniques, i.e., cloud microwave tomography and scanning radar, to retrieve 3D cloud properties that are needed to improve the representation of cloud processes in climate models. A scanning radar provides the sixth moment of cloud droplets, while cloud tomography, by remotely probing cloud microwave emission along multiple directions at distinct locations, offers the third moment (liquid water content). Simulation studies have shown that combining the two techniques allows for not only better retrieving cloud liquid water content but also better retrieving cloud droplet size distribution by relaxing some assumptions used in conventional techniques. Historically, it takes a long time to translate our knowledge gained from cloud observations into global model improvements partially because of a weak linkage between data producers and modelers. Thus the other focus of this research will be on the development of a synergetic instrument simulator for cloud tomography and scan radar, i.e., "data-friendly" algorithms for sampling models in a manner consistent with the way instruments observe. This synergetic simulator, together with the similar works of other ARM data producers, will be a key component of ARM's effort to establish a framework in which the parameterization schemes in latest operational climate and weather forecast models can be evaluated with ARM observations in quasi real time.
